Natural Resource Management Plan 1983

Timpanogos Cave National Monument

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I. INTRODUCTION

Timpanogos Cave National Monument, consisting of 250 acres, is located 35 miles south of Salt Lake City, Utah. The monument was established by presidential proclamation (Number 1640) of October 14, 1922 which stated, in part, that "whereas, a natural cave, known as the Timpanogos Cave, which is situated upon surveyed lands within the Wasatch National Forest in the State of Utah, is of unusual scientific interest and importance, and it appears that the public interest will be promoted by reserving this cave with as much land as may be necessary for the proper protection thereof, as a National Monument."

Surrounded by the Uinta National Forest, the monument is situated within American Fork Canyon. The monument contains a section of the river and flood plain and the very steep, rugged north and south slopes of the canyon. (Map-Appendix I).

The Riparian Woodland of the flood plain contains Cottonwood, Box Elder, and Redosier Dogwood. The canyon slopes are predominately rocky cliffs and talus containing patches of Douglas Fir, White Fir, Mountain Maple, and Gamble Oak.

The area is characterized by hot, dry summers and cold wet winters. Temperature extremes vary from -8°F to +95°F with an average total precipitation of 60 inches. The annual snow fall averages 60-70 inches per year. Snow is normally on the ground from November to May.

Timpanogos Cave National Monument is located in the Wasatch Mountains, a narrow, upfaulted range extending nearly due north from central Utah into southern Idaho.

The majority, ,of the monument is situated on the southern wall above 5,665 feet. The cave system itself is situated on the south slopes at 6,730 feet above sea level.

Rock strata reflecting the geological history of American Fork Canyon are exposed along the 1-1/2 mile trail from the visitor center to the cave entrance. The diagram entitled, "Geologic Strata of American Fork Canyon" is a cross section of the canyon taken at Timpanogos Cave (Appendix 2 and 3).

The cave system consists of three caves (Hansen, Middle, and Timpanogos Caves) connected by man-made tunnels. The total distance through the caves is about 2,300 feet.

Cave temperatures average approximately 43°F year-round.

The annual visitation to the Monument is about 120,000. The caves are open from May 1 to mid-October depending upon the weather and funding. Visitation to the caves is by guided tours only. About 60,000-80,000 visitors go through the caves annually.

Utah State Highway #92 bisects the Monument as it traverses from the Utah Valley floor in the west to the high alpine ridges of Mt. Timpanogos to the east. This highway is usually closed 4 miles upcanyon from the Monument from the first of November to June because of snow depths.

The Monument is adjacent to the highly urbanized Salt Lake City-Provo area along the Wasatch Front Range. There are over 1 million people within a 50 mile radius of the Monument.

This natural resource, management plan is a functional document addressing the Monument's natural resource problems, prioritizing them, and programming future funding for them. This plan is a functional extension of the Monument's Statement for Management.

The General Management Plan of 1983 is now in the stage of being approved by Region and WASO.

Natural Resource Management objectives identified within these two plans include:

1. Evaluating and mitigating the effects of human use and other factors on the cave environment.

2. Prevention of cave formation discoloration and damage.

3. Developing methods of cleaning cave formations without damaging them.

4. Providing adequate protection of the cave during periods when tours are not being conducted.

5. Providing for pleasant, safe visitor enjoyment of the American Fork Canyon without impairing the local ecosystem.

6. Managing riverbanks to reduce the possibility of flooding and continued damage from erosion.

7. Reestablishing and maintaining vegetative ground cover in picnic areas and along river banks where it has been damaged by overuse.

8. Gather adequate baseline ecological information on the cave to meet National Park Service standards in preservation and management of natural areas.

II. OVERVIEW AND NEEDS

Executive Summary

A major resource problem of the area is human impact on cave resources (see below).

The Riparian Plant community has been seriously modified by development on the canyon floor with little chance of rehabilitation.

Other plant communities on the slope are pristine.

Soil erosion has occurred on the canyon slopes from the water line break and shortcutting.

The Monument is relatively small, with extensive development on the floor of the canyon, which precludes a wildland fire management program. All fires will be suppressed in the Monument to protect the monument developed areas.

The Monument is a Class II Air Quality area situated. next to a nonattainment area with higher levels of air pollutants. There appears to be no way the present levels of air pollution in the Monument can be mitigated.

Standing dead trees are hazardous to the visitor and park facilities and are removed from visitor use areas.

Rockfall occurs on the extremely steep canyon slopes and is hazardous to visitors and employees. Verbal and written warnings are given to visitors concerning trail hazards and rockfall. A rockfall shelter has been constructed over the cave exit to protect visitors from falling rocks. The cave ceiling is monitored for breakdown to reduce hazards to visitors.

Water resource management programs (water rights, use, etc.) are extremely complex. There is a need to develop a water resource plan to tie together all the elements of water management within the Monument.

Although insects have been well studied within the Monument, other elements of the flora and fauna are not well documented. There is a need to expand the data base on species composition/distribution of plants, birds, mammals, herpital fauna, aqautic species and cave flora/fauna. There are no known endangered plant or animal species in the Monument. The expanded data base would provide a sounder base for making management decisions. The geology in the monument has been studied in detail to provide management the data it needs to made sound decisions.

A. Explanation

1. Cave Management. The impact on the air quality in the cave is believed to come from human presence. Lint and dirt from unidentified sources is accumulating on the

formations. Temperature, humidity and air patterns :have been altered because of the interconnecting of the caves by the man-made tunnels and external air,pollution may be drawn into the caves as a result. Cave water is diverted for human consumption and to allow access to the cave. Electric lights have stimulated unnatural algae and most growth on the walls and formations of the cave. Humans touching formations along the cave trail has discolored and stopped the growth of some cave; formations.

FIVE-YEAR FUNDING PLAN

Scheduled Accomplishments:

FY-84 - Purchase e,quipment'£or monitoring air quality, lint and dirt, algae and moss, humidity and temperature, and water in the cave resources.

Funding/Staff Required (beyond normal funding levels):

1. Air Quality Monitoring Equipment	$ 40,000
2. Evaluation of Air Quality Readings	$ 5,000
3. Support Costs	
Supplies and Materials	$ 500
Administrative	$ 500
4. Personnel Services	
GS-9	$ 1,033
GS-4	$ 1,929
TOTAL	$ 48,712

FY-(85-88) - Funding/Staff required beyond, normal funding levels:

1. Evaluation of Air Quality Readings	$ 15,000
2. Supplies and Materials	$ 2,000
3. Personnel Services	
GS-9	$ 4,132
GS-4	$ 10,861
TOTAL	$ 31,993

2. Reduce Rockfall Hazard: The steep canyon wall which the cave trail follows from the visitor center to the cave is the source of much of the beauty and charm of the area. Unfortunately, since it is subject to frequent rockfall, this canyon wall is also a source of danger to park visitors. The drainages on the upper third of the trail have the greatest number of rockfall incidents, yet these exposed areas are the very places many visitors choose to stop and rest. Not being familiar-with the steep canyon terrain, these visitors

feel a false security in the openness of these drainages.

While it is not possible to provide greater protection for the visitor without causing severe damage to the natural area, it is possible to increase the safety of the visitor by making them more aware of the potential danger areas.

The areas of greatest rockfall hazard will be identified by actually striping the trail surface with a noticeable but not obtrusive color of paint. The striping, slong with appropriate signing, is intended to increase the visitor's awareness for relatively short, but critical, sections of the trail. If the visitor alertness can be increased while crossing the areas of greatest rockfall, many rockfall injuries can be eliminated.

If rockfall incidences continue, further study may be needed to examine additional safety measures.

FIVE-YEAR FUNDING PLAN

Scheduled Accomplishments:

FY-84 - Purchase buck and rail fencing for installation along the cave trail in the areas where shortcutting occurs with appropriate signing. Purchase paint for trail stripping to identify areas of high rockfall danger.

Funding/Staffing Required (beyond normal funding levels):

1.	Buck and rail poles	25 each	$ 106
2.	Paint	6 gallons	$ 60
3.	Signs	12 each	$ 200
4.	Personnel Services (WG-8)		$ 300
TOTAL			$ 666

FY's-85,86,& 88: Additional funding required to continue above projects:

1.	Paint	36 gallons	$ 360
2.	Personnel Services (WG-8)		$ 450
TOTAL			$ 810

TICA-N-001 CAVE MANAGEMENT

Statement of Problem:

The primary resource of the area is is the cave system located in the south wall of American Fork Canyon, 1,065 feet above the visitor center.

Stalactites, stalagmites, and other common features' are. found in the caves, but it is the, tremendous number of helictites which make these caves unique. Helictities are small cave formations which twist and turn into strange and fantastic shapes as they grow from the' cave walls or roof.

The first cave, Hansen, was discovered in 1887. Following it's discovery, onyx deposits (stalagmites and stalactites) were mined, from it causing extensive damage to the resources throughout the cave (the other two caves; discovered in 1921, werenot mined). In the winter of 1888, Martin Hansen installed a heavy wooden door over the natural entrance to protect the cave.

Later, the natural entrance to Timpanogos Cave was walled off. A man-made entrance was then constructed adjacent to the natural one, with a heavy wooden door installed for protection. A heavy iron grate was placed over the natural entrance to Middle Cave to prevent access.

In May, 1937, a man-made tunnel of 85 feet was finished between Hansen and Middle Caves to provide visitor access. In August, 1938, a second tunnel of 185 feet, between Middle and Timpanogos Caves, was completed. Since this time, it has been observed that when the doors to Hansen Cave and Timpanogos Cave are both open at the same time, a strong draft is created.

There is concern that this unnatural draft is drying out the caves and causing thr formation's growth to slow. It is believed that free water, hydroscopic water and humidity are all affected. The draft is also suspected of blowing dirt and lint into the cave recesses causing formations to become dirty.

If the draft is identified as a problem, some technique, such as establishing tunnel doors, or installing air locks at the entrances, may be needed.

Cave temperatures average approximately 43°F year-round. It is not known whether cave temperature is influenced by unnatural air flows.

The three caves are connected by man-made tunnels so that visitors enter through Hansen Cave, travel through a tunnel into Middle Cave, travel through another tunnel into Timpanogos Cave from which they exit on the far side from the tunnel, a total of 1,800 feet. The caves are small with no large rooms or large passageways. Over the years almost the entire length of the trail has been paved with cement.

Annual visitor use of the cave varies from 60,000 to 80,000. On a peak day 4,000 visitors will tour the caves. To provide interpretation and protection of the formations, all tours are guided and size is limited to 20 people maximum.

There are approximately 150 lights in the cave which provide illumination along the entire trail as well as selected formations. Most lights are 150-250 watt quartz. To light illuminate large formations, 220 volt metal haloid lights are used. In 1979, when the cave lights were rewired, the systems were anchored, and the wire and lights were placed to minimize impact on the formations.

A major problem resulting from the lighting system is the growth of algae and moss arount the lighted area, stimulated by the heat and light from the system. These growths are unnatural and have discolored many formations.

During the last two years, an experimental attempt to eliminate this algae and moss growth with a calcium hydrochlorate solution has not proved very successful. There is a need to identify the plant growth and to develop a method to eliminate the growth without harming the formations.

Lint and dirt are accumulating on many formations, some of which are delicate to touch. There is a need to identify the source and causes of these accumulations so that management actions can be undertaken to correct or mitigate them. There is also a need to develop methods to remove this material from the formations without harming them.

Visitors touch formations within reach along the trail which causes the surface of the formations to become discolored and it retards their growth. This impact has been mitigated by keeping tour groups small enough to be controlled by the guides. Still, there is a need for research to develop techniques to control the discoloration and/or to further mitigate the retardation of formation growth.

There is an increase in air pollution from industry and automobile traffic in Utah County and there is concern that this pollution is entering the caves and having adverse affects on the cave resources. There is a need to evaluate the air quality in the caves to establish whether or not this pollution is, in fact, a threat to the cave resources so that,appropriate management action can be taken.

Body heat and carbon dioxide from visitors are suspected of modifying the cave environment. There is a need to determine whether or not this is the case and, also, if this influencing the cave resource.

Water in the cave system is being pumped out of the caves to provide cave trail access and for use as drinking water by visitors. There is a concern that this removal of natural water from the caves has caused some damage to the formations by drying out them out and retarding growth. There is a need for a study to determine if this is the case so that management action can be taken if needed.

ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS

A. NO ACTION: Maintain the status quo. Under this alternative, control of cave access through locked doors will continue. Visitor use and impact will be managed by requiring guided tours and limiting group size to a maximum of 20 people per tour.

   Radon monitoring will continue and appropriate management actions would be taken if levels unexpectedly rise.

   There would be no research or monitoring of the cave environment or development'of procedures to reduce resource impacts. Trial and error attempts would be made to clean cave formations. This effort may eventually prove successful but it may require many years for results. There is a risk that cave resources will deteriorate due to lack of impact identification and appropriate management actions.

   Natural cave water will continue to be pumped from the cave for visitor access and for drinking water. There is a risk that cave resources will deteriorate due to lack of water to form cave formations.

B. EXPANDED CAVE RESEARCH, MONITORING, AND RESOURCE MANAGEMENT:

   Control of cave access would continue. Visitor use would be managed by tour guides and the 20 person limit on group size would continue unless research shows otherwise. Radon monitoring would continue. Research would be undertaken to establish baseline air quality, algae and moss growth near electric lights would be identified and techniques developed to reduce or eliminate it’s growth, sources of lint and dirt would be identified and techniques developed to clean the formations of lint, dirt, algae and moss, Pumping of water from the cave for visitor access and drinking water would continue unless studies determine that it is harmful to the cave resource. Techniques would be developed to further mitigate the impact of visitors touching the formations. Under this alternative cave formations would be restored to a more natural condition.

RECOMMENDED COURSE OF ACTION:

Alternative B is the recommended course of action. This alternative will restore the cave resources and afford better protection than alternative A.

Resource Management Actions:

1. Maintain security through the heavy wooden doors at the entrance and exit.

2. Maintain control of visitor use in the cave through use of tour guides and limits to tour size.

3. Maintain a high resource protection profile through the constant presence of uniformed personnel and patrols.

4. Implement other resource management actions as research and monitoring programs show need.

Monitoring:

1. Continue radon monitoring.

2. Monitor cave air quality, temperature, humidity, and carbon dioxide levels.

3. Monitor the cave air flow patterns.

4. Monitor the rate of lint and dirt accumulation, algae and moss growth, and touching impacts on the cave formations.

5. Monitor pond water quality and quantity in the caves.

Research:

1. Identify species of algae and mosses growing due to cave lighting system. Develop techniques to eliminate and remove these species from cave formations.

2. Determine the sources of lint and dirt affecting the cave formations and develop techniques to reduce or eliminate these from the air and remove them from cave formations.

3. Develop techniques to reduce discoloration and growth reduction from visitors touching cave formations adjacent to the trail.

4. Establish and interpret cave air baseline data.

5. Establish and interpret cave water baseline data.

TICA-N-002 SOIL AND VEGETATION MANAGEMENT

Statement of Problem:

Due to changes in elevation and exposure, a wide variety of plants are found within the monument. These plants may generally be grouped into three categories by the location in which they are found. The south and west facing slopes, a warm, relatively dry environment, are dominated by Gamble Oak. Other plants usually associated with this environment include Rocky Mountain Juniper, Hackberry, Narrow and Broad Leaf Mahogany, Squaw Bush, Big Sage, and Cliff Rose.

The canyon. floor provides a moist environment suitable for such large trees as Cottonwood, Box Elder, and White Fir mixed with Choke Cherry, Utah Juniper, Oregon Grape and Redosier, Dogwood.

The cold, moist, shaded environment of the north facing slopes support White Fir, Douglas Fir, Rcedosier Dogwood, Big Tooth and Mountain Maple, Elderberry, Jamesia, Dwarf. Juniper and a variety of other plants.

The highway, Utah Highway 92, monument developments and riverbank stabilization have altered the canyon floor and riparian communities to a high degree. There is little chance of mitigating this impact.

The vegetative communities on the slope within the monument are relatively undisturbed except along the access road to the area's water storage, the cave trail and the Utah Power and Light water line. In 1940, the Utah Power and Light water line broke and a large erosion gully several hundred feet to the river was created. In order to restore the land form and ground cover, a slope stabilization plan was developed and implemented in this area. The plan calls for construction of terraces and natural revegetation to correct this problem.

Along the cave trail shortcutting of switchbacks, especially on the upper trail, is causing loss of vegetation and considerable soil erosion and greatly increased rockfall danger. To correct the situation, the shortcutting must be stopped. To facilitate this, buck and rail fencing needs to construeted in areas subject to shortcutting or in areas where they are more appropriate and effective. Sections of fir trees with, branches intact will be used. Appropriate signing will be used to inform visitors of the purpose of the fencing and to' gain the cooperation of the vast majority of trail users. Once the source of the problem is eliminated, a variety of techniques may be used to stabilize the slopes. These include mulching, water bars, and netting, all of which will allow natural regeneration of the vegetation. Supplemental planting of native shrubs and grasses have been used to some extent to insure adequate revegetation. There is a need to expand this program. Trail patrol-is used to prevent. trail shortcutting. The mitigating impacts of visitors on soil and vegetation in the development zone, particularly the picnic ground and around the visitor center, are addressed in the General Management Plan.
There are many different types of exotic grasses and plants around the developed zones that we do not know how to manage.

ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. NO ACTION: Maintain status quo. Under this alternative the present program will be maintained. Gully erosion from the Utah Power and Light line break will be controlled. Erosion from shortcutting on the cave trail will be controlled through barriers, signing, supplemental planting and other methods. The program will help restore disturbed vegetative communities and soil in the monument.

B. DISCONTINUE PRESENT PROGRAM: Fully erosion control efforts would cease. Erosion adjacent to the. cave trail would be allowed. This would 'risk creating even greater damage to the soil, and vegetation in the area.

RECOMMENDED COURSE OF ACTION:

A. NO ACTION: Recommended course of action will be alternative A.
Resource Management Action:

1. Maintain trail patrols to reduce visitor shortcutting on slopes.

2. Maintain water line gully erosion control and vegetation rehabilitation program.

3. Maintain cave trail erosion control and vegetation rehabilitation program.

Monitoring Actions:

1. Routinely monitor monument area for erosion and vegetation changes.

TICA-N-0003 WILDLAND FIRE MANAGEMENT

Statement of Problem:

The cave and developed areas are located 3 miles up American Fork Canyon with Utah Highway 92 going through the Monument. The monument is located within the Uinta National Forest.

The frequency of natural and man-made fires is extremely low, at estimates of one fire every 10 years. The high humidity and low temperatures, spotty fuels and low level of ignition risk contribute to the above. There are continuous stands of Fir and Oak brush on the slopes of the monument. These fuel stands could carry the fire into forest service land.

The area is too small, with too many developed zones, to permit a natural fire management plan. The policy is to suppress all fire and cooperate with the Forest Service to suppress all fires.

ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. NO ACTION: Maintain status quo. Suppress all wildland fires. Maintain cooperation with Forest Service. This alternative will insure that all monument developed structures and human life and safety are protected. This program will preclude the role of natural fire in the monument's limited vegetation communities.

B. DEVELOP A FIRE MANAGEMENT PLAN: Human caused fires and fires threatening developed zones will be suppressed. Naturally ignited fires will be permitted to burn. Under this alternative vegetative communities under the natural zone would be permitted to burn. However, this would create risk to the development on the canyon floor and possibly harm human life and safety.

C. LET ALL WILDLAND FIRES BURN: Under this alternative the human and natural fires would be allowed to burn. This alternative is unacceptable because of the risk to, human life and safety, and the risk to the developed areas. This would create la higher than natural fire occurance amoung the monument's vegetative community.

RECOMMENDED COURSE OF ACTION:

It is recommended that alternative A, No Action, be adopted.

Resource Management Actions:

1. Suppress all wildiand fires in the monument.

2. Maintain cooperation with the Forest Service concerning wildiand fire suppression.

Research:

1. Sometime in the future the monument may consider having research done on the importance of fire in maintaining the vegetative communities.

TICA-N-0004 AIR QUALITY MANAGEMENT

Statement of Problem:

The monument is classified as a Class II airqua1ityarea under the 1977 Clean Air Act amendment. The monument is located in Utah County, which, as a portion of the state designated Provo Air Quality. Maintenance Area, is identified as having the potential for violation of particulate matter air quality standards within 10 years.

Although air quality is not monitored in the monument, the Utah Bureau of Air Quality maintains a number of such monitors in Utah County. Data are available from the Bureau on air quality trends.

At times, highly visible air pollution from Utah Valley has backed up into the canyon. The major concern at the monument is that the air pollution may adversely affect the caves. There may be a need to develop a monitoring program for the air both inside and outside the caves. The monitoring in the caves is addressed in TICA-N-0001, Cave Management.

ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. NO ACTION: Maintain the status quo. Air quality would not be monitored at the monument. No baseline would be established, and possible air quality deterioration would not be determined.

B. MONITORING AIR QUALITY: Establish an air monitoring program. This would establish a baseline and begin to determine trends. In conjunction with the,cave air monitoring program, it could help determine any possible adverse effects.

RECOMMENDED COURSE OF ACTION:

Alternative B, Monitoring Air Quality, is recommended. Air quality monitoring outside the caves should be. carried out in conjunction with interior monitoring.. The staff will request the Utah Bureau of Air Quality to send a representative to the monument to determine the feasibility of establishing such a monitoring program.

A. Monitoring: Establish air quality monitoring program in the park.

TICA-N-0005 HAZARD TREE MANAGEMENT

Statement of Problem:

Large cottonwoods, box elders, and fir trees die from various causes. Those trees located in public-use areas pose a hazard to the safety of park visitors and employees, as well as public and private property. As such trees are located, they are removed. Dead trees are not removed if they are located outside visitor-use areas.

ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. No Action: Maintain the status quo. Hazardous trees will continue to be identified and removed. Some habitat loss to wildlife species dependant on standing dead trees, as well as loss of nutrients to the soil can be expected. However, human injury, property damage, and the resulting tort claims are avoided.

B. DISCONTINUE TREE REMOVAL PROGRAM: More habitat would be available for those wildlife species dependant on standing dead trees and the soil would obtain the nutrients from the rotting trees. However, the standing dead trees would constitute a significant hazard to park visitors, employees, and property.

RECOMMENDED COURSE OF ACTION:

Alternative A, No Action, is the recommended course of action.

Resource Management: Continue removing hazardous trees within developed areas as they are identified.

Continue to monitor developed areas for hazardous trees.

TICA-N-0006 GEOLOGICAL HAZARD

Statement of Problem:

Natural rockfall from very steep canyon slopes endangers human life and safety, as well as property, within the monument. A rockfall barrier has been constructed above the cave trail and a shelter over the exit to prevent humans from being injured from falling rocks. Signs, .pamphlets, verbal and written warnings create an awareness of the hazard to the visitor. An Environmental Assessment was completed in May, 1976 concerning rockfall hazards.

Within the cave there has been some cave breakdown in the last 500 years. The cave is visually monitored for cracks. If there is a danger to the visitor the cave will be closed.

The cave is located within an area in which earthquakes are known to happen. If a series of earthquakes should occur, then the cave would be closed.

ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. NO ACTION: Maintain the status quo. Monitoring of the ceiling of the. cave would continue. Earthquake activity will be monitored and when there is activity in this area, the cave will be closed. Human life and safety will be protected from cave breakdown occurring in the cave. Outside expertise would be requested to determine the proper steps to take in dealing with new or enlarging cracks.

B. To gain information concerning earthquake activity in this area, the USGS Office in Salt Lace City, University of Utah and the local news media will be consulted.

C. NO MONITORING: Discontinue programs. Under this alternative, changes in the cave may not be noticed. This is unacceptable due to the obligation to protect those using the cave.

D. EXPAND THE CAVE MONITORING PROGRAM: Under this alternative,equipment would be placed in the visitor center to detect earthquake activity in the area. When activity is registered, the cave would be closed. If visual monitoring of the cave ceilings in the cave reveal new or enlarging cracks, we would install instruments to monitor the hazard. If the cracks increased in size or number, the cave would be closed.

2. This alternative would provide more immediate information so that we would know when to close. the cave to protect the visiting public.

RECOMMENDED COURSES OF ACTION: ALTERNATIVE A

1. Maintain an awareness of earthquake activity.

2. If cracks occur in the ceiling or there is increased earthquake activity in the area, the cave will be closed.

3. Plan to call in outside expertise to examine the cracks to determine what steps should be taken.

Monitoring:

1. Continue visual monitoring of the cave ceiling for cracks.

TICA-N-0007 WATER RESOURCE MANAGEMENT

Statement of Problem:

The American Fork River flows through the monument for 3,000 feet east to west down the American Fork Canyon, then through Utah Valley to Utah Lake. The water is gauged by the U.S.G.S. above the monument and 2/3 of the water is diverted by the Utah Power and Light Power Plant allowing a small amount to flow through the monument.

The river banks within the monument have been greatly modified to stabilize the banks in order to control the meandering of the river as it flows through' the monument. This was done to protect the developed facilities of the monument as well as Utah Highway 92. The actual river channell has not been changed or modified. The quality of the water is chemically checked for bacteria by the.,, Utah State Health Department at least twice monthly during the year.

During the heavy runoff season, the park's staff will insure the river is free of log jams. When one does occur it is immediately removed.

The watershed is located above the monument in the Uinta National Forest and is about 50 square miles. There are two small man-made reservoirs located 6 to 8 miles above the monument. The monument is concerned over the possibility of these dams breaking and flooding the canyon. The dams are inspected annually by, the U.S.F.S. and Utah State Inspectors. We maintain a channel of communication with those that do` the inspections of the dams to insure the dams are safe.

Siltation from one of the gold mines approximately 11 miles up American Fork Canyon from the visitor center has been observed in the river flowing through the monument. Damage to aquatic resources is unknown at this time..

All water in the American Fork River is claimed by a number of irrigation companies.

The Cave Spring, located in the monument by the west boundary, is boxed off by American Fork City. This water is diverted to the city of American.Fork for culinary use.

The water resource program is. complex in terms of water rights and uses. Seven agencies are involved in water rights at the Monument, however, no other agency has a.culinary claim to the water source used by the monument.

A Water Resource Management Plan is needed to tie together the water management policy in the monument.

The Monument's culinary water source consists of two boxed springs located on U.S.F.S. land approximately 1 mile north of the monument's. boundary in the Lone Peak Wilderness Area.

The water is chlorinated prior to public use. To assure safety, bacteriological samples are taken twice each month. All sewage-in the monument is disposed of through ground absorption. Periodic tests are conducted to assure that the river is not contaminated by park sewage.

ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. NO ACTION: Maintain the status, quo. Continue to treat water used for human consumption, monitor water quality of both culinary and river water. Maintain liason concerning upstream dams in order to monitor potential danger. Maintain monument water rights and commitments. Remove log jams from channel to prevent flooding of park facilities. Provide an adequately, safe supply of water for use by the park and visitors. Assure that park activities do not cause deterioration of water quality for downstream users.

B. DISCONTINUE WATER MANAGEMENT PROGRAMS: Under current law and operating conditions this alternative is not feasible. Public health and safety would not be provided for and water rights commitments would not be honored.

C. PREPARE A WATER RESOURCE MANAGEMENT PLAN: To consolidate all elements of water management within the monument to provide a systematic basis for management decisions and actions, a management plan would be developed.

RECOMMENDED COURSES OF ACTION:

A combination of both alternative A and C is selected. Resource Management:

1. Maintain commitments to water users and maintain park water rights.
2. Maintain water quality for park users and users downstream.
3. Maintain an awareness through,liason with upstream agencies, of dam conditions.
4. Remove logs from river channel to prevent flooding of park facilities.
5. Develop a Water Resource Management Plan

Monitoring:

1. Monitor water for chemical or bacteriological contamination of culinary water.

2. Monitor for contamination of river from park sewage.

3. Monitor river channel for changes and log jams which may threaten park developments.

TICA-N-0008 GENERAL FLORA AND FAUNA MANAGEMENT

Statement of Problem:

There are two general ecosystems within Timpanogos Cave National Monument. The surface ecosystem has flora-fauna-aquatic systems. The flora consists of Chaperall Oak and Riparian (cottonwood and box elder). The Riparian zone of the monument has been unavoidably disturbed by the highway and monument development. These ecosystems have not been completely mapped or described. A plant collection has been done for the monument which consists of 200 plants and a small herbarium has been completed for the monument. The monument is too small to represent a range of terrestrial or mammal life. Mule deer, mountain lion, and coyotes are occasionally seen in the monument.

Small mammals such as skunks, raccoons, chipmunks, mice,, and ground squirrels are common. A few bats may be found in the caves but they are not common. A detailed study of the mammal's habitats has not been done for the monument.

Birdlife abounds in the monument. The most common types are wrens, thrashers, thrushes, kinglets, waxwings, vireos, and woodwarblers.

Several types of snakes, including the Great Basin Rattlesnake, are found in the park and lizards are common on the rocky ledges.

There are checklists for the major terrestrial vertebrates but there has been no major study done.

The aquatic ecosystem of the monument includes german brown and rainbow trout, both of which are exotic. Public fishing for these species is permitted in the monument.

The quality of the river is good even through much of the river flow has been diverted to other uses above the monument.

It is unknown if there are other aquatic invertebrates within the monument and a study of the major aquatic invertabrates needs to be completed.

An extensive collection of terrestrial invertebrates was completed by Park Ranger David H. Huntzinger in 1965.

Bats, crickets, mice-and mites are known to be part of the cave fauna.

There is no cave flora except for the algae and moss growing near the electric lights.

Few cave aquatic species are known and only two types have been found, Spring Tail and mites, which are invertebrates. There are no known cave aquatic vertebrates.

There are no known endangered plants or animals within the monument. However, species lists are incomplete and there is a need to develop a more complete species list.

Decisions relating to flora-fauna-aquatics within the monument have been difficult due to the lack of a complete data base.

Signs, pamphlets, and patrols are used to protect the flora-fauna-aquatics of the monument from being harmed.

ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. NO ACTION: Maintain the status quo. The present database is inadequate to make most management decisions and there is a risk that a wrong decision could be made concerning sensitive or endangered species within the monument. Patrols of the monument to protect the flora-fauna-aquatics would be maintained.

B. EXPAND DATABASE FOR FLORA-FAUNA-AQUATICS: The monument would strive through research contracts to have resource base studies completed. Under this alternative, there would be an adequate data base to implement management decisions to manage these resources.

RECOMMENDED COURSE OF ACTION:

The recommended course of action would be a combination of A and B. Present programs would continue until funding is available to expand programs.

Research: Expand data base on cave and terrestrial flora and fauna on the monument.

TICA-N-0009 GEOLOGICAL RESOURCE MANAGEMENT

Statement of Problem:

(Excluding the cave; see TICA-N-0001). The geological features of American Fork Canyon have been extensively studied (see Appendix Bibilograph of Geological References; Geological Strata of American Fork Canyon).

The theme of geological resource management is used in interpretive programs. Natural rock, collected from rock falls on the trail and from the bar ditch along the road, is used in the construction of rock retaining walls along the cave trail and in the developed areas of the monument.

However, the collection of native rock by visitors is discouraged through patrols by park personnel.

The steep slopes and cliffs are mentioned in Geological Hazards.

ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACT:

A. NO ACTION: Maintain the status quo. Consider the present data base sufficient to meet management needs. Continue ranger patrols to protect geological features. Continue to collect native rock for construction of retaining walls on the cave trails and other work in the developed areas. Continue to present the geological resource theme in interpretive presentations.

B. EXPAND DATABASE: This additional data would be nice; however, it is not a great need at this time.

RECOMMENDED COURSE OF ACTION:

The recommended course of action is a combination of A and B.

Resource Management:

1. The monument is patrolled to prevent rock collecting by visitors.

Research:

1. Geological research from outside institutions should be encouraged, but there is no need for NPS funding.

TICA-N-0010 CAVE WATER MANAGEMENT

Statement of Problem:

There are six intermittent pools of water within the cave system. The largest pool, 12 feet deep, 25 feet long, and 12 feet wide, is in the Hansen Cave.

Since shortly after the establishment of the monument, water has been piped from the pool in Hansen Cave to the cave entrance and is the only source of drinking water for the visitor at the cave. The water is stored in two redwood tanks (2,500 gallons each) for use as it is needed and, by August, the water in the pool is drawn down to the bottom. It is tested daily and batch chlorinated as necessary to meet Utah State Health Department requirements.

In the first room of Middle Cave is a pool of water that has an electric pump installed in it to remove water when the level reaches a given height. This is done to insure the water will not rise higher than the foot bridge over the pool and prevent access, as well as to prevent the water from covering any electrical boxes. If the water rises too high, access to this part of the cave will be prevented.

ALTERNATIVE ACTIONS AND THEIR PROBABLE IMPACTS:

A. NO ACTION: Maintain the status quo. Continue to use the water from the pool in Hansen Cave for drinking water and continue to pump water out of the cave to prevent flooding of the cave trail and electrical system. Although the pools naturally fluctuate throughout the year, the impact of removing more water than is natural will remain unknown.

B. DISCONTINUE PRESENT ACTIONS: We would have to derive other methods of providing drinking water for cave visitors. Cave tours could not be conducted during periods when the water was above the bridge in Middle Cave. The electrical system would have to be redesigned to prevent it from being flooded by the high water.

   On the other hand, the fluctuation of the cave water level would be more natural.

C. RESEARCH ON FLUCTUATION OF WATER IN THE CAVE: Research would have to be conducted to determine if the unnatural fluctuation is causing harm to the cave resources.

RECOMMENDED COURSE OF ACTION:

The recommended course of action is a combination of A and C.

Resource Management:

1. Continue to pump water out of the cave to prevent flooding of the cave trail and electrical system.

2. Drinking water will be continued to be piped to the Grotto for visitor use.

Research:

1. Conduct research to determine if there is any adverse impact on the cave due to the unnatural fluctuation of the cave water levels.

TICA-N-0011 WEATHER-ACID RAIN MANAGEMENT

Statement of Problem

Historically the weather here at Timpanogos Cave National Monument has been natural, however, in the past few years there has a been a great deal of weather modification during the winter months to increase the amount of snow fall so that there will be enough spring runoff for the summer water users. This program worked and snow depths increased in the mountains.

Timpanogos Cave National Monument has maintained a weather station in cooperation with the National Oceanic and Atmospheric Administration's Environmental Data Service. This weather station is located on the north slope of American Fork Canyon behind residence #8. Standard weather information is collected daily and each month it is sent to the National Climatic Center where long term records are maintained. A copy of these reports is kept in the monument files.

The Clean Air Act (as amended) is responsible for making the air clean for us to breath. However, the surrounding area around the monument is a nonattainment area.

Of all pollutants, acid rain remains the most insidious threat to the nation. Acid rain occurs when sulfur dioxide and nitrogen oxide combine with the moisture in the air. Researchers claim the smokestacks of giant, coalburning industries are a major source of acid rain and the Geneva Steel Mill in nearby Orem, Utah falls into this category.

It needs to be determined first, if acid rain occurs in the area of the monument and second, if it does, a study should be conducted to determine the effects of the acid rain on the cave resources. Part of the second study should include methods to protect and clean the cave resources.

ALTERNATIVES AND THEIR PROBABLE IMPACTS:

A. NO ACTION: Maintain the status quo. The present data base is inadequate to make management decisions and there is a risk that wrong management decisions could be made that would be harmful to the cave resources.

   The present weather program is adequate.

B. BASELINE AND MONITORING PROGRAM: There is a need' for research in the monument concerning the effects of acid rain on the cave resources. It should be determined if there is an acid rain problem in the area of the monument and, if so, what impact it is having on the cave resources. Techniques will need to be developed to protect and clean the cave resources also.

Monitoring should be carried out to gain a base line to determine when acid rain is prevelant in the monument and how it is affecting the cave.

The present weather program is adequate.

RECOMMENDED COURSE OF ACTION:

The recommended course of action is a combination of A and B. At the present time alternative A is to be followed until funding is available to carry out alternative B.

Research Management:

1. A study needs to be completed to determine if there is acid rain in the area of the monument and if it is reaching the cave resources.

2. It needs to be determined what adverse impacts acid rain has on the cave resources.

3. It needs to be determined what techniques are needed to protect and clean the-cave resources without causing additional damage to the cave resources.

Monitoring:

1. Continue to monitor the cave resources to determine when acid rain is present and if the cave resources should be cleaned.

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